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ABSTRACT

The purpose of this study to determine if information high in the logical structure of a passage tends to be recalled better than information low in the structure. Two groups of 24 Cornell undergraduates participated in the experiment. Subjects in each group read and recalled three passages. Group one read the Breeder Reactor High, Schizophrenia Low, and Parakeet High passages. Group two read the Breeder Reactor Low, Schizophrenia High, and Parakeet Low passages. The experiment was conducted in two sessions. In the first, subjects read each passage and produced a written free recall of it immediately after reading. In the second session, one week later, subjects were again asked for a free recall of each passage. Then they were given lists of the content words found in the target paragraphs of each passage and asked to produce a third free recall of each passage, using these words to aid them. The findings indicated that: information is more likely to be recalled from a passage if it is high in the content structure than if it is low; information is more likely to be retained over time from a passage if it is high in the content structure than if it is low; and providing cues for recall one week after reading increases the recall of information high and low in the content structure of the passage. (WR)

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EFFECT OF POSITION OF INFORMATION IN A PASSAGE'S ORGANIZATIONAL STRUCTURE ON RECALL[1,2]

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After reading a passage, people are unable to remember all the information it contained. When a number of people read or hear the same passage, some ideas from it are recalled by almost everyone, whereas other ideas are recalled by very few. Meyer & McConkie (1973) found that some of this variability could be accounted for by structural aspects of the passage. Information higher in the logical structure of the passage tends to be better recalled than that lower in the structure. There were two main problems with that study, however. First, the approach to discourse analysis which was used to obtain the logical structure of the passage was a very subjective one. Second, there was no control for the nature of the content of the passage high and low in the logical structure. Thus, the content high in the passage may have been concrete, thus having greater potential for imagery (Yuille and Paivio, 1969; Anderson, in press), or the terms or concepts may have had a higher cultural frequency, etc. The experiment to be reported here employed better controlled stimulus materials to investigate the same question, whether information high in the logical structure of a passage tends to be recalled better than information low in the structure.

MATERIALS

For this research, Meyer (1974) developed a technique for analyzing a passage which yields a tree-structure representing the structure of the relationships asserted in the text. This discourse analysis technique is based on the work of the Cornell linguist, Joseph Grimes (in press), referred to as the semantic grammar of propositions. It views a passage as being a complex proposition which can be decomposed into sub-propositions bearing certain relations to one another. There are assumed to be two types of predicates, with that term being used in the logician's sense: lexical predicates and rhetorical predicates. Lexical predicates are centered in a lexical item, typically a verb, which takes arguments in case role relationships. Rhetorical predicates are not centered in lexical items, but still take arguments. The rhetorical predicates frequently appear at higher levels in the structure of a passage, representing intersentential relationships.

The product of this analysis of a passage is a tree-structure, with segments of the content of the passage as nodes, and with labelled relationships. This structure will be referred to as the content structure of the passage. This content structure pictures the structure of relationships asserted in the passage, showing how some ideas are subordinate to others, and classifying the relationships.

The discourse analysis technique developed for this research has much in common with that of Frederiksen (1973). The passages used in this study were approximately 575 words in length, and when analyzed had from 7 to 15 levels in their content structure. Six passages were produced, two on each of six topics: Schizophrenia, Nuclear Breeder Reactors, and Parakeets. On each of these topics a paragraph was written which was included in both passages on that topic. This is called the Target Paragraph. One of the passages on each topic, the high passage, was written in such a way that, when analyzed, the information in the Target Paragraph stood at the top of the content structure. The other passage, the Low Passage, was so written

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that in its content structure the information in the Target Paragraph stood at the lowest levels. Both passages on the same topic were the same length, and had the same number of words occurring prior to and following the target paragraph. Thus, physical position in the passage was constant.

The structural analysis of these passages appears to be reliable. Grimes and Meyer independently analyzed these passages and were in 95% agreement on the content structure. Disagreement centered on specifying the relationship labels; there was no disagreement on which content was high and low in the content structures.

PROCEDURE

Two groups of 24 Cornell undergraduates each participated in the experiment. Subjects in each group read and recalled three passages. Group I read the Breeder Reactor High, Schizophrenia Low and Parakeet High passages. Group II read the Breeder Reactor Low, Schizophrenia High, and Parakeet Low passages. Order of presentation was counterbalanced within groups.

The experiment was conducted in two sessions. In the first, subjects read each passage and produced a written free recall of it immediately after reading. In the second session, one week later, subjects were again asked for a free recall of each passage. Then they were given lists of the content words found in the Target Paragraphs of each passage and asked to produce a third free recall of each passage, using these words to aid them. This is called the Cued Recall Task.

Subjects were tested in groups of five to fifteen. The entire task required about three hours, and subjects were paid $5.25 for their time. The experiment included other groups reading other types of passages which will be ignored for this report.

Scoring: The recalls were scored by assigning them 1 point for each content unit or relationship from the original content structure which was included in the recall. They were scored for substantive content, rather than for exact wording. Thirteen recalls were independently scored by two scorers, who agreed 99% of the time on whether items from the content structure should be counted as present or absent in the recall.

Complete information on scoring procedures can be found in Meyer (1974).

RESULTS

Recall scores for the Target Paragraphs are presented in Table 1. Delayed recalls of the Parakeet passages have not been scored. As can be seen, in every case recall was significantly higher when the paragraph was high in the content structure, rather than low. This result was strong and consistent. This was not due to differences in passage difficulty, since total recall scores for the entire passages did not differ: 34% of the units were recalled from both Nuclear Breeder Reactor passages, and for the Schizophrenia passages 25% were recalled from the High version and 28% from the Low.

Table 2 reports the difference in Target Paragraph recall scores between immediate and delayed testing, and between delayed free and delayed cue testing. An analysis of variance of these data indicated significantly more loss over time for Target Paragraphs when low than when high in the structure ($F[1,80\ df] = 5.814$, $p < .025$), with no significant effect for passage topic and no interaction. Difference between delayed free and cued recall did not vary with passage topic or content structure position. Thus, presence of the cues produced approximately equal increments of recall, over delayed free recall scores, in all conditions.

It appears, then, that information high in the content structure of a passage is more likely to be recalled immediately after reading, and is subject to less forgetting over time.

One explanation for the recall superiority of high information might be that, since information high in the passage sets the theme of the passage, it is repeated more frequently in the passage. To check this explanation, the High and Low versions of the Nuclear Breeder Reactor passage were searched for instances of four types of repetition of content units from the Target Paragraph: verbatim repetition, substantive repetition, detailed restatement and implicit reference. It was found that 12 of the 46 idea units in the Target Paragraph were repeated at least once in the text of the high version of the passage, while 8 were repeated in the low version. Of these, nine were repeated more frequently in the High version, and 5 were repeated more frequently in the Low version. Thus there was somewhat more repetition in the High version. However, amount of repetition did not seem to be related to likelihood of recall. Of the 9 units repeated more frequently in the high version of the passage, 8 were recalled better from that version. Of the 5 units repeated more frequently in the low version, 4 were better recalled in the high version. Of the 28 units not repeated, 19 were recalled better in the High version. These data were taken from immediate recalls, and the related recall showed an even greater tendency for better recall of units from the High version, regardless of repetition frequency. Thus, while there was slightly more repetition of Target Paragraph information in the High version of the passage, this could not account for the superior recall from that version,

DISCUSSION

The three findings of this research were: (1) information is more likely to be recalled from a passage if it is high in the content structure than if it is low; (2) information is more likely to be retained over time from a passage if it is high in the content structure than if it is low; and (3) providing cues for recall one week after the original reading increases the recall of information high and low in the content structure of the passage about equally.

First of all, these findings point out the importance of the content structure of a passage as a determiner of the learning and retention of information from the passage. Further research is needed to investigate the influences of more detailed aspects of the structure. Discourse analysis techniques such as the one developed for this research make it possible to conduct this type of research.

Second, these findings bear on various theoretical positions regarding learning from prose. The recall superiority of high information immediately after learning could be accounted for from either a selectivity in learning or a retrieval position.

That is, it may be that the content structure guides the reader's attentional processes, causing him to be more likely to select for storage that information high in the passage structure. On the other hand it may be that high and low information are equally stored, but that the laws of retrieval are such that high information is more likely to be recalled under free recall conditions. The present study does not allow the testing of these two alternatives.

In the same way, the greater loss of recall of low information over time could be due either to a differential rate of loss from memory, or to structural changes which cause lower information to be less accessible to retrieval for free recall, though the information is still present in memory and is accessible in other ways. The subsumption theory of Ausubel (1963) takes the first position, suggesting that peripheral information (that which is lower in the content structure) is subsumed by the more central information (that higher in the structure) over time, thus losing its independent identity and becoming less available for recall. The cued recall data provides some help in discriminating among these theoretical positions. If the recall loss were due simply to structural changes which make the information less accessible to free recall, though still present in memory it would appear reasonable that it would be recalled under cued conditions. A reasonable prediction might then be that information low in the structure, which has been most subject to loss of accessibility to free recall, would be aided most by the presence of cues. Although the data pattern was in this direction, the differences were not significant. Thus, low information appears to be more rapidly lost from memory or subsumed over time, and not to simply become inaccessible to free recall.

Third, the results from this research have certain practical implications. They suggest that those preparing curriculum materials should be careful to place important information high in the content structure of the instructional text, to insure its retention. Also, the type of text analysis developed, which reveals the structure of the content of a passage, may well have pedagogical value itself. If some students fail to detect the interrelations among ideas in the text, thus acquiring a fragmented representation of the content, then giving them experience with this sort of text analysis in which they are able to see the total structural pattern of a passage may aid them in their reading.

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FOOTNOTES

1. This paper was presented at the meetings of the American Educational Research Association, April, 1974, in Chicago, Illinois. For copies, please write to: Dr. Bonnie Meyer, 106 Old Farms Lane, New Milford, Connecticut, 06776.

2. This research was conducted as part of Dr. Meyer's Ph.D. dissertation research. It was partially supported by Hatch Act funds from the U.S. Department of Agriculture

TABLE 1

Mean Recall for Target Paragraphs in High and Low Content Structure Positions for Immediate and Delayed Free Recall and Delayed Cued Recall Conditions

Target Paragraph Topic	Recall Condition	Content Structure Position High	Low	Degrees of freedom	t	Probability
Breeder Reactor (46 units in target)	Immediate Free Recall	18.05	13.43	40	1.981	.05
	Delayed Free Recall	14.81	4.43	40	5.186	.0005
	Delayed Cued Recall	25.57	19.67	40	1.945	.05
Schizophrenia (46 units in target)	Immediate Free Recall	19.71	13.90	40	2.319	.025
	Delayed Free Recall	14.14	7.09	40	2.823	.005
	Delayed Cued Recall	26.00	19.57	40	2.527	.01
Parakeets (33 units in target)	Immediate Free Recall	44.24	34.57	40	2.75	.005

TABLE 2

Mean Differences Between Immediate and Delayed Free Recall Scores, and Between Delayed Cued and Delayed Free Recall Scores for Target Paragraphs in High and Low Content Structure Positions

Passage	Content Structure Position	Mean Recall Condition Differences	
		Immediate Free-Delayed Free	Delayed Cued-Delayed Free
Breeder Reactor	High	2.86	10.76
	Low	8.73	15.19
Schizophrenia	High	5.62	11.86
	Low	7.00	12.67